Inferred Color Photography Supported by Helical LiDAR Impervious to Diffraction Effects

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Introduction

Although a number of strategies have been proposed for overcoming the so-called "Diffraction Limit" associated with orbital photography, many of them having come from this author; including the concept of using clusters of telescopes with precisely offset orientations in order to create a type of synthetic aperture capable of creating images of higher resolution, helical light affords us an opportunity to create images based upon light which is not subject to diffraction effects.

Abstract

In order to leverage helical light in order to deduce the true color of an object being photographed or measured, one must begin with a standard LiDAR measurement. Helical light can greatly enhance the resolution and range of space-based LiDAR measurements which have heretofore been based upon using a single beam which, with diffraction effects, winds up being 2-3 feet in diameter when it reaches the surface of the Earth. Helical beams, particularly when frequency multiplexed, allow for three-dimensional maps to be created which are both precise and complete without the need to make repeated passes to create such maps. The conjunction of the frequency-multiplexing capability and the helicization capability, as I have written previously, allow for high-precision three-dimensional maps to be created at extreme range without concern about diffraction. These maps, however, do not provide information concerning the color or reflective properties of the objects; only their three-dimensional shape.

Helical light has a tendency to de-helicize when reflected by an object. Thus, the return light from such a LiDAR emitter would be severely limited, however, it would be sufficiently strong to be detected and measured.

We can infer the true color of an object in such a mechanism from the strength of the returned light at each frequency provided that the helical light used is in the visible spectrum and provided that every frequency is tested. As the helical light travels toward the object, it encounters conventional ambient light traveling in the opposite direction and this creates opportunities for phase cancellation. When the helical light interacts with light of the same frequency, its own intensity is diminished.

Beginning from this premise, we can infer that if we project a broad spectrum of visible frequencies using a standard frequency multiplexing prism coupled with a helicizer toward objects on the surface of the Earth, *that the intensity of the returned light will be the weakest for the light matching the true color value of the object being photographed, at least when measuring only helicized light and disregarding any ambient light which is non-helicized.*

Not only may we precisely measure the three-dimensional contours of objects at a distance, we can use the backscattered helical light's relative intensity according to color to infer the color of the object the range of which is being assessed. This would be not a direct measurement of the ambient light, but a measurement of the way in which ambient light negates the projected light associated with a LiDAR system which enables us to infer the properties of the ambient light.

We may also measure the relative brightness or darkness of an area with respect to ambient light using this approach, by measuring the degree to which the helical light is attenuated.

Ordinarily, a light beacon emitted from an orbital platform would be insufficient to illuminate the surface of the Earth sufficiently to support the capture of a photograph. However, because of the zero-diffraction nature of helical light, a comparatively weak light source can generate a sufficiently strong reflection to take a useful measurement just as anyone who has ever shone a light toward a road sign with a retro-reflective coating could attest. When bombarded with helical light, all objects behave very much as do retro-reflective coatings.

In order to achieve this, in addition to both a standard frequency multiplexing prism and the helicization prism, a third, rotating discus prism must be used in order to rapidly rotate the input frequency for the multiplexing prism so that every possible visible frequency can be tried against an object being measured. It is only by comparing the strength of return for each possible frequency against a given spatial point on the Earth that color information and ambient brightness information could be returned.

In order to compensate for the effect of the platform being in motion in Low-Earth Orbit (and given the non-zero time it takes for the input frequency to rotate,) the color-diminution effects must be compared against appropriate, corresponding areas of multiple captured images which represent the same spatial point but which may occupy different relative regions of the photographs. For example, by the time the input-frequency modifying discus has finished rotating through all possible input colors, the object being photographed can be expected to have migrated from the right-hand side of the field of view to the left-hand side. The precise migration of the object would have to be tracked in order to ensure that the relative return strength comparison is an "apples to apples" comparison.

Conclusion

As this approach would involve the use of not one, but three different prisms (one of which would be designed to rotate and would involve a complex meta-analysis of signal returns relative to color as well as to a migrating relevant photograph region, this would certainly qualify as a complex mechanism. However, it is a complex mechanism which is built upon established first-principles and is a natural outgrowth of previous inventions promulgated by this author.

Whereas the fundamental problem in diffraction is the inability of the light to maintain a stable trajectory toward the observation platform rather than a paucity of natural light in the vicinity of the objects being photographed, it stands to reason that helical light, which does not scatter, when used judiciously could, even in small quantities, be the logical vehicle for overcoming this ancient problem.